



## spondylocostal dysostosis

Spondylocostal dysostosis is a group of conditions characterized by abnormal development of bones in the spine and ribs. The bones of the spine (vertebrae) are misshapen and abnormally joined together (fused). Many people with this condition have abnormal side-to-side curvature of the spine (scoliosis) due to malformation of the vertebrae. In addition to spinal abnormalities, some of the rib bones may be fused together or missing. Affected individuals have short, rigid necks and short torsos because of the bone malformations. As a result, people with spondylocostal dysostosis have short bodies but normal-length arms and legs, called short-trunk dwarfism.

The spine and rib abnormalities, which are present from birth, cause other signs and symptoms of spondylocostal dysostosis. Infants with this condition have small chests that cannot expand adequately, often leading to life-threatening breathing problems. As the lungs expand in the narrow chest, the muscle that separates the abdomen from the chest cavity (the diaphragm) is forced down and the abdomen is pushed out. The increased pressure in the abdomen can cause a soft out-pouching around the lower abdomen (inguinal hernia), particularly in males with spondylocostal dysostosis.

Some people with spondylocostal dysostosis also have a type of birth defect known as a neural tube defect. Neural tube defects occur when a structure called the neural tube, a layer of cells that ultimately develops into the brain and spinal cord, fails to close completely during the first few weeks of embryonic development. Examples of neural tube defects that occur in people with spondylocostal dysostosis include a spinal cord abnormality known as spina bifida and a brain abnormality called a Chiari malformation.

Although breathing problems can be fatal early in life, many affected individuals live into adulthood.

Spondylocostal dysostosis has often been grouped with a similar condition called spondylothoracic dysostosis, and both are sometimes called Jarcho-Levin syndrome; however, they are now considered distinct conditions.

### Frequency

Spondylocostal dysostosis is a rare condition, although its exact prevalence is unknown.

### Genetic Changes

Mutations in several genes are known to cause spondylocostal dysostosis. The most common form of the condition, spondylocostal dysostosis type 1, is caused by

mutations in the *DLL3* gene. Mutations in other identified genes each account for a small number of cases of the condition.

The *DLL3* gene and other genes involved in spondylocostal dysostosis play roles in the Notch signaling pathway, which is important in embryonic development. One of the functions of Notch signaling is directing the separation of future vertebrae and ribs from one another during early development, a process called somite segmentation. When the Notch signaling pathway is disrupted, somite segmentation does not occur properly, resulting in the malformation and fusion of the bones of the spine and ribs seen in spondylocostal dysostosis.

Mutations in the identified genes account for approximately 25 percent of cases of spondylocostal dysostosis. Researchers suggest that additional genes involved in the Notch signaling pathway might also be associated with the condition.

## **Inheritance Pattern**

Spondylocostal dysostosis can have different inheritance patterns. Most types, including type 1, are inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. The parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but they typically do not show signs and symptoms of the condition. Other types of spondylocostal dysostosis are inherited in an autosomal dominant pattern. Autosomal dominant inheritance means that one copy of an altered gene in each cell is sufficient to cause the disorder. The signs and symptoms of spondylocostal dysostosis are typically more severe with autosomal recessive inheritance.

## **Other Names for This Condition**

- Jarcho-Levin syndrome
- SCDO

## **Diagnosis & Management**

### Genetic Testing

- Genetic Testing Registry: Jarcho-Levin syndrome  
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C0265343/>
- Genetic Testing Registry: Spondylocostal dysostosis 1, autosomal recessive  
<https://www.ncbi.nlm.nih.gov/gtr/conditions/CN032975/>
- Genetic Testing Registry: Spondylocostal dysostosis 2  
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1837549/>
- Genetic Testing Registry: Spondylocostal dysostosis 3  
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1853296/>

- Genetic Testing Registry: Spondylocostal dysostosis 4, autosomal recessive  
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C3150942/>
- Genetic Testing Registry: Spondylocostal dysostosis 5  
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1852521/>
- Genetic Testing Registry: Spondylocostal dysostosis 6, autosomal recessive  
<https://www.ncbi.nlm.nih.gov/gtr/conditions/CN232941/>

#### Other Diagnosis and Management Resources

- GeneReview: Spondylocostal Dysostosis, Autosomal Recessive  
<https://www.ncbi.nlm.nih.gov/books/NBK8828>
- KidsHealth: X-Ray Exam (Scoliosis)  
<http://kidshealth.org/en/parents/xray-scoliosis.html>
- MedlinePlus Encyclopedia: Scoliosis  
<https://medlineplus.gov/ency/article/001241.htm>

#### General Information from MedlinePlus

- Diagnostic Tests  
<https://medlineplus.gov/diagnostictests.html>
- Drug Therapy  
<https://medlineplus.gov/drugtherapy.html>
- Genetic Counseling  
<https://medlineplus.gov/geneticcounseling.html>
- Palliative Care  
<https://medlineplus.gov/palliativecare.html>
- Surgery and Rehabilitation  
<https://medlineplus.gov/surgeryandrehabilitation.html>

### **Additional Information & Resources**

#### MedlinePlus

- Encyclopedia: Scoliosis  
<https://medlineplus.gov/ency/article/001241.htm>
- Health Topic: Chiari Malformation  
<https://medlineplus.gov/chiarimalformation.html>
- Health Topic: Neural Tube Defects  
<https://medlineplus.gov/neuraltubedefects.html>
- Health Topic: Scoliosis  
<https://medlineplus.gov/scoliosis.html>

- Health Topic: Spina Bifida  
<https://medlineplus.gov/spinabifida.html>
- Health Topic: Spine Injuries and Disorders  
<https://medlineplus.gov/spineinjuriesanddisorders.html>

#### Genetic and Rare Diseases Information Center

- Spondylocostal dysostosis  
<https://rarediseases.info.nih.gov/diseases/12174/spondylocostal-dysostosis>

#### Additional NIH Resources

- National Institute of Arthritis and Musculoskeletal and Skin Diseases: Scoliosis  
[https://www.niams.nih.gov/Health\\_Info/Scoliosis/](https://www.niams.nih.gov/Health_Info/Scoliosis/)
- National Institute of Neurological Disorders and Stroke: Chiari Malformation Fact Sheet  
<https://www.ninds.nih.gov/Disorders/All-Disorders/Chiari-Malformation-Information-Page>
- National Institute of Neurological Disorders and Stroke: Spina Bifida Fact Sheet  
<https://www.ninds.nih.gov/Disorders/All-Disorders/Spina-bifida-Information-Page>

#### Educational Resources

- Cleveland Clinic: Spinal X-ray  
<http://my.clevelandclinic.org/health/articles/spine-x-ray>
- Disease InfoSearch: Spondylocostal dysostosis 1  
<http://www.diseaseinfosearch.org/Spondylocostal+dysostosis+1/6802>
- KidsHealth: Dwarfism  
<http://kidshealth.org/en/parents/dwarfism.html>
- MalaCards: spondylocostal dysostosis  
[http://www.malacards.org/card/spondylocostal\\_dysostosis](http://www.malacards.org/card/spondylocostal_dysostosis)
- National Organization for Rare Disorders (NORD): Jarcho-Levin Syndrome  
<https://rarediseases.org/rare-diseases/jarcho-levin-syndrome/>
- Orphanet: Autosomal dominant spondylocostal dysostosis  
[http://www.orpha.net/consor/cgi-bin/OC\\_Exp.php?Lng=EN&Expert=1797](http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=1797)
- Orphanet: Autosomal recessive spondylocostal dysostosis  
[http://www.orpha.net/consor/cgi-bin/OC\\_Exp.php?Lng=EN&Expert=2311](http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=2311)

### Patient Support and Advocacy Resources

- Little People of America  
<http://www.lpaonline.org/>
- Scoliosis Research Society  
<http://www.srs.org/>
- Spina Bifida Association  
<http://spinabifidaassociation.org/>

### GeneReviews

- Spondylocostal Dysostosis, Autosomal Recessive  
<https://www.ncbi.nlm.nih.gov/books/NBK8828>

### ClinicalTrials.gov

- ClinicalTrials.gov  
<https://clinicaltrials.gov/ct2/results?term=%22spondylocostal+dysostosis%22+%5BDISEASE%5D+OR+NCT00001754+%5BID-NUMBER%5D+OR+NCT00854828+%5BID-NUMBER%5D+OR+NCT01087034+%5BID-NUMBER%5D>

### Scientific Articles on PubMed

- PubMed  
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28spondylocostal+dysostosis%5BTIAB%5D%29+OR+%28%28jarcho-levin+syndrome%5BTIAB%5D%29+OR+%28scdo%5BTIAB%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22%5Bdp%5D>

### OMIM

- SPONDYLOCOSTAL DYSOSTOSIS 1, AUTOSOMAL RECESSIVE  
<http://omim.org/entry/277300>
- SPONDYLOCOSTAL DYSOSTOSIS 2, AUTOSOMAL RECESSIVE  
<http://omim.org/entry/608681>
- SPONDYLOCOSTAL DYSOSTOSIS 3, AUTOSOMAL RECESSIVE  
<http://omim.org/entry/609813>
- SPONDYLOCOSTAL DYSOSTOSIS 4, AUTOSOMAL RECESSIVE  
<http://omim.org/entry/613686>
- SPONDYLOCOSTAL DYSOSTOSIS 5  
<http://omim.org/entry/122600>
- SPONDYLOCOSTAL DYSOSTOSIS 6, AUTOSOMAL RECESSIVE  
<http://omim.org/entry/616566>

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